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The enigmatic robber fly *Choerades mouchai* Hradský, 1985 redescribed and recorded from the Alps (Diptera, Asilidae)

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Abstract

Records of *Choerades mouchai* Hradský, 1985, are reported from Switzerland. These are the first records of the species published since its description and extend its known range to include the Alps. Previously, it was known only from parts of the Carpathian Mountain chain in Slovakia and Romania. A redescription of the male is provided, accompanied by photographs of diagnostic features, including the terminalia, and images of the entire insect. A table listing morphological differences between the males of *Ch. mouchai*, *Ch. femorata* and *Ch. marginata* is presented. The *Choerades* fauna of Switzerland is discussed, as is the information available about the ecology of *Ch. mouchai*.

Key Words

Robberfly, Faunistics, Switzerland, Europe

Introduction

The robber flies (Diptera, Asilidae) comprise about 600 species in Europe. Recent works on the central and northern European asilid fauna have significantly improved species identification and promoted faunistic studies (Goot 1985; Weinberg and Bächli 1995; Geller-Grimm 2003; Van den Broek and Schulten 2017; Wolff et al. 2018; Haarto et al. 2022). Despite these advances, there is no key which provides for the identification of all the *Choerades* species known from Europe. One reason for this is the unclear taxonomic status of some of them, such as *Ch. fulva* (Meigen, 1804), *Ch. podagrica* (Meigen, 1820) and *Ch. dioctriaeformis* (Meigen, 1820). Further, the females of two species, *Ch. castellanii* (Hradský, 1962) and *Ch. mouchai* Hradský, 1985 remain unknown. Apart from the work of Weinberg and Bächli (1995), the *Choerades* fauna of the Swiss Alps remains poorly studied.

The genus *Choerades*, which is part of the sub-family Laphriinae, is represented by at least ten species in central Europe. Adults are formidable predators and their larvae develop in the wood of old trees, where they predate the larvae of saproxylic insects. From the studies of Krivosheina and Mamayev (1975), larvae of some *Choerades* species are known to develop in deciduous trees, including *Ulmus*, *Fagus* and *Quercus*. Others, like *Ch. marginata*, *Ch. gilva* and *Ch. ignea* develop in conifers, such as *Pinus* or *Picea*.

The description of *Choerades mouchai* was based on males from Slovakia, in the north-western part of the Carpathians, and from Romania, in the south-eastern Carpathians, all collected more than 60 years ago (Hradský 1985). Since then, there appear to have been no published records of the species. The lack of clarity in the description of the species and its accompanying figures, plus the fact that *Ch. mouchai* has not been included in any key dealing with the European fauna, must have contrib-

uted to this lack of records. With that in mind, the new records of *Ch. mouchai* from the Swiss Alps, presented here, are accompanied by an illustrated redescription of *Ch. mouchai*, together with notes on its separation from the morphologically similar species *Ch. femorata* (Meigen, 1804) and *Ch. marginata* (Linnaeus, 1758). Ecological observations on *Ch. mouchai*, gathered from two of the three Swiss localities are also discussed.

Materials and methods

During surveys of selected families of Diptera in the Swiss central Alps, the male of an unfamiliar *Choerades* species was collected by one of us (GP) in a dry *Pinus sylvestris/Quercus pubescens* forest. First identified as *Ch. femorata*, its very particular terminalia led to further research in the literature and specialist expertise was also sought. This resulted in the discovery (by JB) of a second Swiss specimen of the same species. Collected in 2011, in the eastern Swiss Alps by M. Kadlecová, it was obtained from an insect exchange in Prague. A third male was then found by Christian Monnerat (info fauna, Neuchâtel) in his private collection, among material collected by an interception trap set up for saproxylic Coleoptera, in the central Swiss Alps, within an old *Fagus* slope forest.

Literature research brought to light Milan Hradský's description of *Ch. mouchai* (Hradský 1985) from the Carpathian Mountains. This description only partially matched the Swiss males. As the description and the illustrations provided in Hradský (1985) were insufficient to confirm the identity of these males, a comparison between them and the holotype and paratypes of *Ch. mouchai* in Hradský's collection was made (by JB). Photographs of one of the paratypes were also taken by Michal Tkoč at the Museum in Prague.

Results

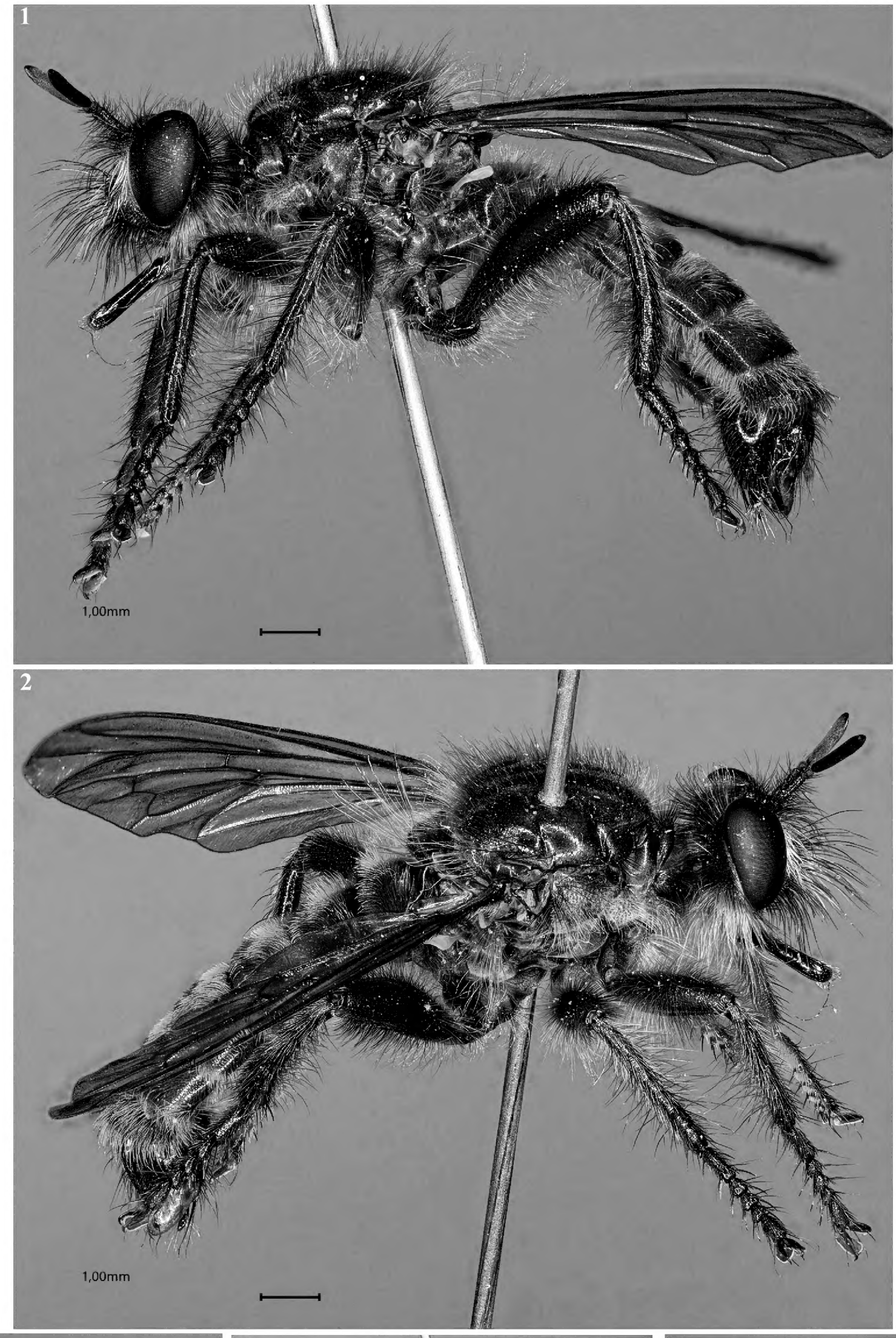
Records of *Choerades mouchai* from the Alps

Material examined. 1♂, Switzerland, Graubünden, Rätische Alp Nord, 3 km E of Susch, 46°46'N, 10°06'E, 1410 m a.s.l., 12 Aug. 2011, M. Kadlecová leg., J. Bosák det. & coll. ; 1♂, Switzerland,Wallis, Fully, Planuit, 46°09'18"N, 7°06'34"E, 1193 m a.s.l., 9 July 2019, Y. Chittaro leg, G. Pétremand det., C. Monnerat coll., interception trap installed on old *Fagus* tree, MONNECH01005228 ; 1♂, Switzerland, Wallis, Sierre, Bois de Finges, 46°17'45"N, 7°34'38"E, 605m a.s.l., 17 May 2020, G. Pétremand leg., det. & coll., hand net, sitting on a *Quercus* log within Ononido-pinion forest, GBIFCH01022956.

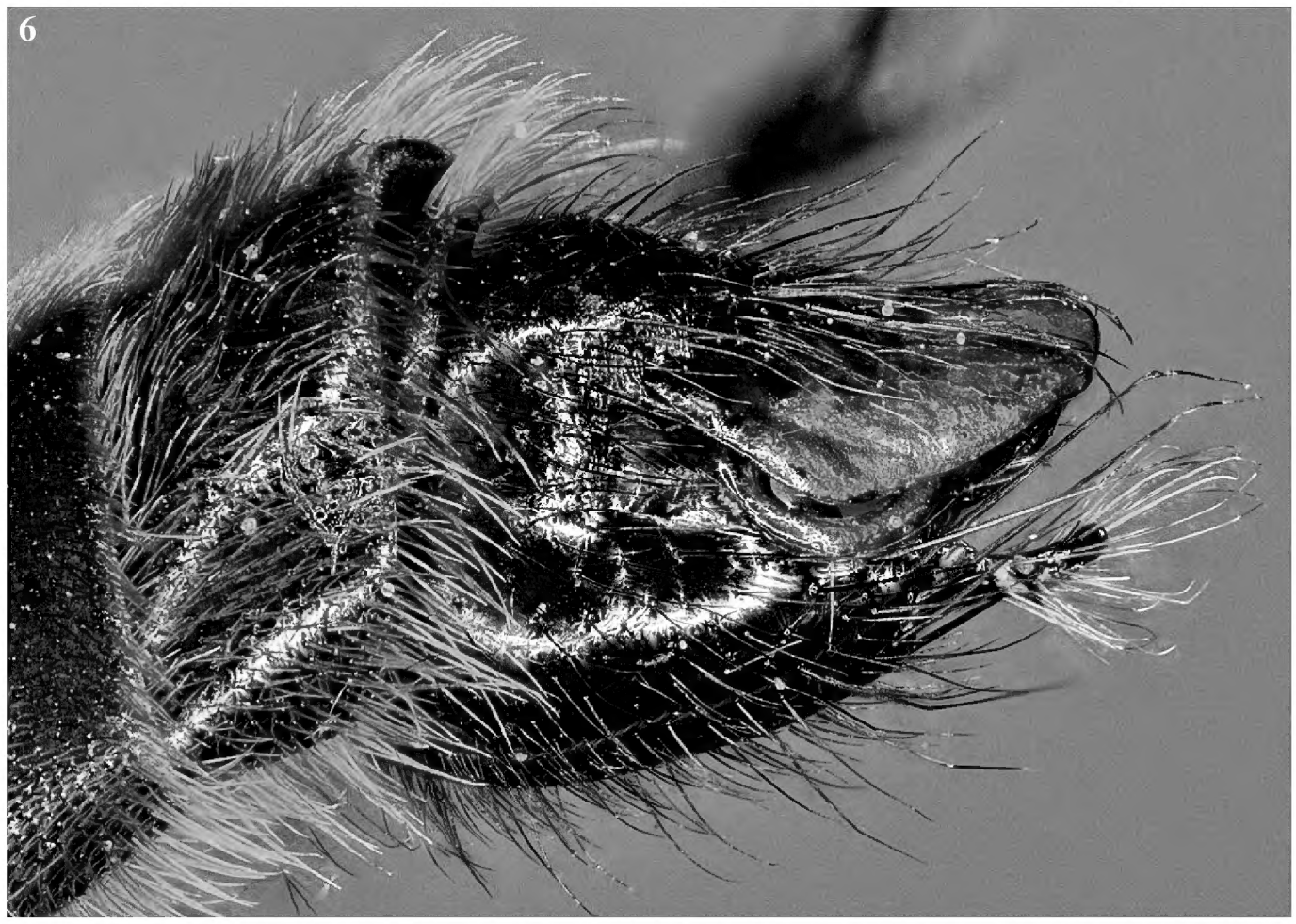
Redescription of *Choerades mouchai* Hradský, 1985. To consolidate Hradský's (1985) description of *Ch. mouchai* we provide a new diagnosis based on Hradský's first description, augmented by data from the Swiss specimens, and accompanied by photos of one of the Swiss specimens (Figs 1–8) and photos of a paratype (from the Carpathian Mountains) (Figs 9, 10).

Diagnosis. *Ch. mouchai* is a black, white and golden haired Laphriinae species. Body length 12–14 mm (Figs 1–4, 9). ***Head.*** Antennae black, with black hairs on the first two segments. First antennal segment about three times longer than second (Fig. 5). Third antennal segment longer than the first and second combined. The cusps, to which the antennae are attached, are covered with black hairs. Mystax with long black hairs, mixed with shorter white bristles (Fig. 1, 4). Face with long silverish hairs on sides (Fig. 4), dense dusting along the eye margins and black bristles medially. Ventral part of the head with very long whitish hairs (Fig. 4). Proboscis black, with white hairs at tip (Fig. 4). Palpi with black hairs. Back of the head (posterior to ocellar triangle) with yellow hairs. Occipital hairs black on upper half and yellowish on lower half. Frons with mainly yellow hairs (Fig. 2). Ocellar triangle with two very long, glassy white/yellow hairs (sometimes absent). ***Thorax.*** Mesoscutum black, with three longitudinal stripes of dusting which are connected at its posterior margin (Fig. 2, 3). Lateral margins of mesoscutum dusted; shiny parts with blue reflections. Mesoscutum with long black hairs and shorter yellow hairs, but posterior margin with only long yellow hairs (Fig. 2). Hairs and bristles on scutellum yellow, bristles on its posterior margin about two times longer than the maximum length of the scutellum. Pleurae dusted. Posterior anepisternum mostly covered with yellow hairs, black hairs present on upper and posterior margins (Fig. 2). Wing membrane slightly darkened except at the wing base, with areas bare of microtrichia. Wing veins dark brown. Dorsal surface of the base of the costa with black and sometimes yellow hairs (Fig. 4). Legs black, with brownish-yellow short hairs and longer black hairs and bristles. Hind femur with yellow and black hairs, some of them on the ventral and dorsal faces about as long as its maximum depth. ***Abdomen.*** Sternites and tergites all shiny black. Tergites black with blue reflections and covered with dense golden hairs. Posterior margins of tergites with denser hair covering, hiding the basic colouration of the abdomen, which is visible on the anterior parts of tergites 1–5. Sternites with long yellow hairs. ***Terminalia*** (Figs 6–8, 10). Gonopod black at the base, brown to yellow towards the tip, with black hairs. Epandrium almost entirely black, ending with two or three prominent black hairs which are curved at the tip. Black pointed projection terminating the hypopygium covered in yellowish-white hairs only.

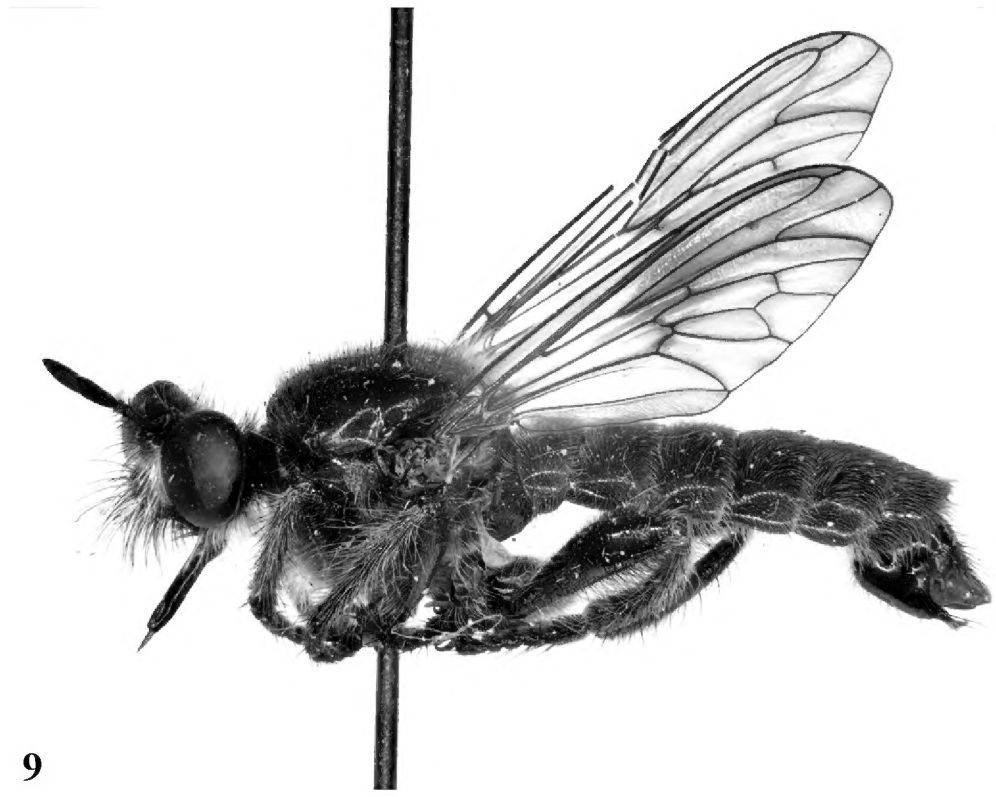
Distinctions between *Choerades mouchai* males and similar species in Europe. The male of *Ch. mouchai* is very similar to the males of *Ch. marginata*, and *Ch. femorata* and could easily be confused with either of them. As an aid to their identification, we list in Table 1 morphological differences between the males of these three species, which can be used to separate them. The male of *Choerades castellani* is also very similar but shows a unique character, its last tergite being bifid posteriorly (see Geller-Grimm, 2003). It has therefore not been included in Table 1.

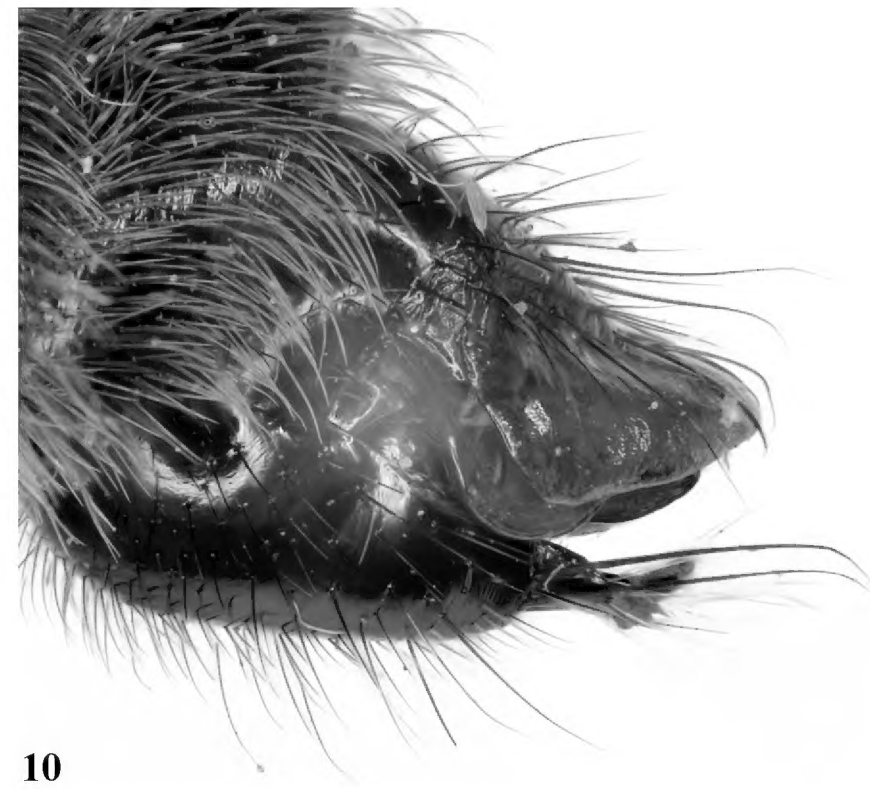


Figures 1–5. *Choerades mouchai* male found in Bois de Finges (Switzerland) on 17th of May 2020. **1.** Habitus, lateral view; **2.** Habitus, oblique view; **3.** Habitus, dorsal view; **4.** Habitus, frontal view; **5.** Head in dorsal view.



Figures 6–8. Terminalia of *Choerades mouchai* male found in Bois de Finges (Switzerland) on 17th of May 2020. **6.** Hypopygium, lateral view; **7.** Hypopygium, dorsal view; **8.** Hypopygium, ventral view.





Figures 9, 10. *Choerades mouchai*, male paratype from Carpathian moutains. **9.** Habitus, lateral view; **10.** Hypopygium, lateral view.

Table 1. Characters allowing the distinction between *Ch. marginata*, *Ch. femorata* and *Ch. mouchai*.

Character	*Choerades marginata* ♂ Fig. 11	*Choerades femorata* ♂ Fig. 12	*Choerades mouchai* ♂ Figs 1–10
coarse hair coloring on face [between antenna and facial gibbosity]	yellow	white to yellow	white (only present along eye margin, centrally absent, see Fig. 4)
mesoscutum	uniformly bright	uniformly bright	bright with three longitudinal pollinose stripes (sometimes not visible, especially in specimens passed in alcohol)
terminalia	uniformly black	uniformly black	gonopod black and bright yellow at tip
length of the 1st segment of antenna [in dorsal view]	1.8–2.5 times longer than 2nd segment	at 3–4 times longer than the 2nd segment	2.7–3.2 times longer than 2nd segment
hair color on tergites	yellow, brown-black hair on disc and white hair on the rear margin of tergites	yellowish-brown hair	golden-yellowish hair, very dense on rear margin
pilosity length on ventral and dorsal surface of hind femur	at most as long as half the depth of hind femur	at most as long as half the depth of hind femur	some hairs almost as long as maximum depth of hind femur
hair color on posterior anepisternum	mainly black (except for a few yellow hairs on lower third)	mainly black (except for a few yellow hairs on lower third)	mainly yellow except black hair in upper and posterior parts
Ecological demands	colder locations of mixed and coniferous forests	xerotherm localities of forest steppe character with deciduous trees	xerotherm localities of *Pinus* or *Fagus* forest

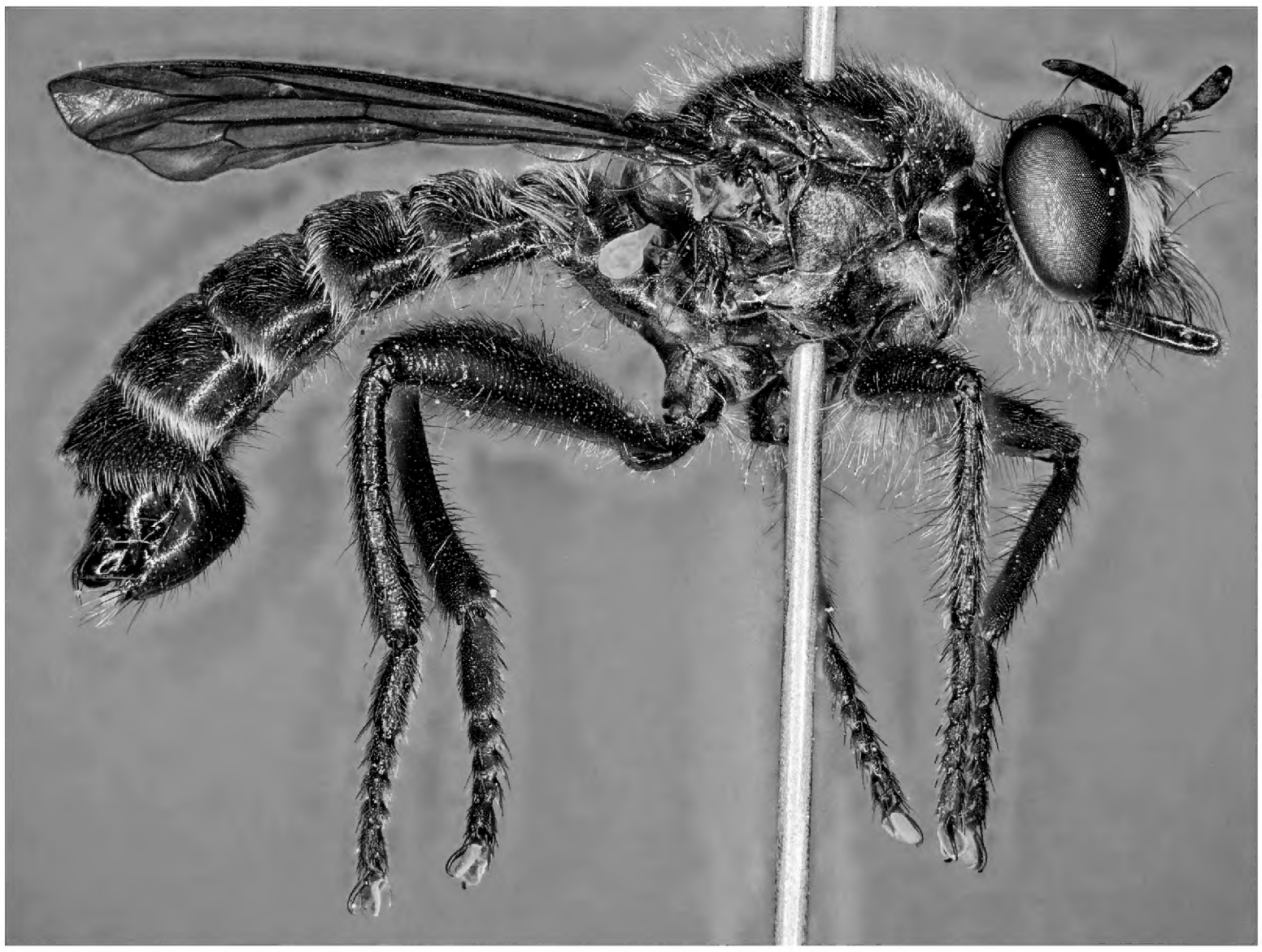


Figure 11. *Choerades marginata* male, habitus in lateral view (Switzerland).

Discussion

Weinberg and Bächli (1995) list eight species of *Choerades* for Switzerland and by extension for the Alps, including the problematic *Ch. dioctriaeformis* and *Ch. fulva*. Commentary on the latter two species is beyond the scope of the present text. *Choerades femorata* should be added to this list, a species omitted by Weinberg and Bächli (1995) but which is frequent in Switzerland. In the past, this species has long been confused with *Ch. marginata*. The addition of *Ch. mouchai* thus brings the *Choerades* fauna of the Alps to ten species. Two other *Choerades* species recently found in Germany (Geller-Grimm et al. 2003; Wolff et al. 2021) can also reasonably be expected to occur in the Alps: *Ch. castellanii* and *Ch. amurensis* (Hermann, 1914).

At present is seems that *Ch. mouchai* is poorly represented in public or private collections, only nine specimens being known - Romania, Slovakia (Carpathians - Hradský 1985) and Switzerland (Alps – this study). With the presence of *Ch. mouchai* in the Alps highlighted by the present text, it is to be hoped that re-examination of material in collections might reveal further records. It is interesting that for the time being there is no evidence of the occurrence of this species in the territory between the Carpathian and the Alps such as in the Czech Republic and Austria, two countries where the asilid fauna has been intensively studied.

In the Carpathians, *Ch. mouchai* has been found in *Pinus mugo* forest (M. Hradský, pers. com.). The records from the central Alps allow us to extend the habitat range of *Ch. mouchai* to dry *Pinus sylvestris* forest mixed with *Quercus pubescens* (Ononido-pinion) and to old and dry *Fagus* slope forest. The male collected by the first author in 2020 was sitting on a dead *Quercus* log fallen on the forest floor. It remains unknown if the larva of

Figure 12. *Choerades femorata* male, habitus in lateral view (Switzerland).

Ch. mouchai is associated with conifers (*Pinus*) or deciduous trees (*Quercus/Fagus*). Nevertheless, it seems to develop in thermophilic forest situations where both coniferous and deciduous trees are present, within old forests.

Conclusions

Discovery of *Choerades mouchai* in the Alps has enabled us to clarify the diagnostic features of the male, hopefully facilitating acquisition of further information about the distribution, biology and ecology of the species, and bringing us one step closer to the development of a key to the *Choerades* species of central Europe.

The detailed diagnosis provided should also improve the possibility of recognising the female of *Ch. mouchai*, leading potentially to its description in the years to come.

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